Simple model for the dielectric function of a completely ionized plasma with an arbitrary ionic charge, that is valid for the long-wavelength perturbations is derived using approximate solution of a linearized Fokker-Planck kinetic equation for electrons with a Landau collision integral.

The model accounts for both the electron-ion collisions and the collisions of the subthermal (cold) electrons with thermal ones. The relative contribution of the latter collisions into dielectric function is treated phenomenologically introducing some parameter $\kappa$ which is chosen in such a way to get well-known expression for stationary electric conductivity [1] in low-frequency region and fulfill requirement of vanishing contribution of electron-electron collisions at high frequency region.

This procedure ensures the applicability of our model in the wide ranges of plasma parameters as well as the frequency of the electromagnetic radiation.

Unlike interpolation formula proposed earlier by Brantov et al. [2], our model fulfills the Kramers-Kronning relations and permits generalization for the cases of degenerate and strongly-coupled plasmas. Taking in mind this fact, the generalization of the well-known Lee-More model [3] of statical conductivity and it’s extension [4] for dynamical conductivity for dense Lorentz plasmas for the case of plasmas with arbitrary ionic charge is proposed.

References: